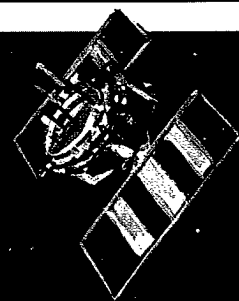




# JOINT LOGISTICS COMMANDERS GUIDANCE FOR USE OF EVOLUTIONARY ACQUISITION STRATEGY

TO ACQUIRE WEAPON SYSTEMS



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# REPORT DOCUMENTATION PAGE

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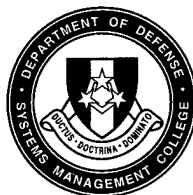
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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 1998	3. REPORT TYPE AND DATES COVERED Manual	
4. TITLE AND SUBTITLE Joint Logistics Commanders Guidance for Use of Evolutionary Acquisition Strategy to Acquire Weapon Systems			5. FUNDING NUMBERS	
6. AUTHOR(S) Ed Hirsch, BG USA (ret), Executive Institute and representatives from the Services (Army, Navy, AF, MC and DLA). Representatives of the Office of the Secretary of Defense.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Defense Systems Management College 9820 Belvoir Road Attn DSMC Press Ft. Belvoir VA 22060-5565			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Defense Systems Management College Attn DSMC Press 9820 Belvoir Road Ft. Belvoir VA 22060-5565			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT  Approved for public release; distribution unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  The Joint Logistics Commands offer this EA process as a tailored, streamlined acquisition strategy for acquiring weapon systems. The EA process is consistent with current guidance and can help shorten the time between requirement genesis and systems availability. We are publishing this guide to encourage consideration and use of the EA strategy for future weapon systems development and when existing weapons are modified to improve their capabilities.				
14. SUBJECT TERMS Policy Statements about Evolutionary Acquisition; Characteristics which Indicate Consideration of an Alternative Acquisition Strategy; Adopting an Acq. Strategy which Accommodates Change.			15. NUMBER OF PAGES 48	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

1998 RE-ISSUE

**JOINT  
LOGISTICS COMMANDERS  
GUIDANCE  
FOR USE OF  
EVOLUTIONARY  
ACQUISITION STRATEGY  
TO ACQUIRE  
WEAPON SYSTEMS**

**REISSUED AND  
REVISED JUNE 1998  
WITH A NEW FOREWORD**



*For additional copies of this guidebook, contact the  
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or visit the DSMC Home Page at <http://www.dsmc.dsm.mil>*

**PUBLISHED BY THE  
DEFENSE SYSTEMS MANAGEMENT COLLEGE PRESS  
FORT BELVOIR, VA 22060-5565**

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## FOREWORD

# JOINT LOGISTICS COMMANDERS GUIDANCE FOR USE OF EVOLUTIONARY ACQUISITION STRATEGY TO ACQUIRE WEAPON SYSTEMS

In May 1995, the Defense Systems Management College (DSMC) published the Joint Logistics Commanders Guidance for Use of Evolutionary Acquisition Strategy to Acquire Weapon Systems. The Guide was commissioned by the Joint Logistics Commanders, developed by a project team led by DSMC that included representatives from the Services and the Defense Logistics Agency. The DSMC was charged with the responsibility for keeping the document current. The fulfillment of that charge is the purpose of this Re-Issue.

The Re-Issue changes the title of Chapter One from "Policy Statements About Evolutionary Acquisition" to "Historical Basis for the Genesis of the Evolutionary Acquisition Process." The Chapter is itself unchanged; Chapters Two through Five also remains unchanged.

More importantly, the Foreword to the Re-Issue identifies significant changes in the environment in which defense acquisition processes must operate and provides current and additional rationale for the use of Evolutionary Acquisition in the development, acquisition, modification, and sustainment of defense systems.

Edward Hirsch  
BG USA (ret)  
Chair, Acquisition Management  
Executive Institute  
Defense Systems Management College



## **JOINT LOGISTICS COMMANDERS GUIDANCE FOR USE OF EVOLUTIONARY ACQUISITION STRATEGY TO ACQUIRE WEAPON SYSTEMS**

The First Joint Logistics Commanders' (JLC) statement on Evolutionary Acquisition (EA), *Evolutionary Acquisition: An Alternative Strategy for Acquiring Command and Control (C<sup>2</sup>) Systems* [1] was published in March 1987. It responded to a clearly discernible need to reduce the time necessary to field Command and Control systems – a need driven by the rapid acceleration in technologies used in such systems.

By the beginning of 1995, technology in general was advancing at a rapid rate. Due to major developments in material sciences, several concepts were advanced for development of a family of ground combat vehicles using a single chassis with a multi-purpose propulsion unit. These vehicles used newly developed material to improve their survivability in combat. The new designs also reduced target cross section. In addition, newly developed materials and design practices made it possible to field combat aircraft combining superior performance capability and lowered radar visibility.

In May of 1995, the JLC issued a replacement for the 1987 Guidance document entitled, *Joint Logistics Commanders Guidance For Use Of Evolutionary Acquisition Strategy To Acquire Weapon Systems* [2]. The preface to that document said: "The JLC offer this updated EA process as a tailored, streamlined acquisition strategy for acquiring weapon systems...consistent with current guidance...[which] can shorten the time between requirement genesis and weapon systems availability."

The revised JLC Guidance also referenced the ongoing evaluation of the Defense Acquisition Process, which completely reviewed acquisition policy. The newly created Deputy Under Secretary of Defense for Acquisition Reform [DUSD(AR)] promulgated sweeping change to existing regulations to facilitate a better, faster, less expensive acquisition process. That activity has resulted in large numbers of substantive policy revisions including: (1) Substitution of Performance Specification for Technical Specification in Requests for Proposal; (2) Stated preference for use of commercial off-the-shelf (COTS) equipment and nondevelopmental items (NDIs) rather than newly designed and developed system elements; and (3) Use of a "Form, Fit, and Function" based design process known as "Open Systems Architecture" to design new systems and to improve the capabilities of in-service systems.

A demonstration of how all of these policy reforms coalesce within an EA process was shown by the Joint Logistics Advanced Concept Technology Demonstration Program (JL-ACTD). Using the newly authorized Acquisition Reform policies and EA methodology, a fully functional, responsive logistics support information and command and control system was put into operational use in Major Operational Commands within one year after program inception. While 100 percent of the system hardware was COTS, 80 percent of the system software was composed of NDIs. The JL-ACTD was reported to the Acquisition Community in the summer issue of the *Acquisition Review Quarterly* (Pp.349 *et. seq.*) [3] Because it was designed and produced using EA strategy, the system continues to evolve in use and by so doing, provides field Commanders with the capability to affect system changes which respond to their changing needs in operational situations.

Evolutionary Acquisition methodology also enables retrofit activities that not only provide immediate new or improved functional capabilities, but also concomitantly equip an operating system with the capability to accept continuing component changes that accommodate technological improvement and increase operational performance.

The promise for EA to provide Field Commanders with improved operational performance, which the JLC first saw in 1987, has by now been clearly demonstrated.

Section VII of the *Report of the Quadrennial Defense Review* (issued in May 1997). [4] It reported on the concepts – developed by the Chairman, Joint Chiefs of Staff in “*Joint Vision 2010*” – as a “template for how America’s armed forces will channel the vitality and innovation of our people and leverage technological opportunities to achieve new levels of effectiveness in joint military operations.” Achievement of the “*Revolution in Military Affairs (RMA)*” places emphasis on: (1) Information Superiority: The Backbone of Military Innovation – “...developing the improved information and command and control capabilities needed to significantly enhance joint operations”; (2) Dominant Maneuver – “Enabling control of the battlespace through the multidimensional application of information, engagement and mobility capabilities...”; (3) Precision Engagement – which “enables joint forces to shape the battlespace through near real-time information on the objective or target, common awareness of the battlespace for responsive command and control...”; (4) Full Dimensional Protection – “...requires a joint architecture that is built upon information superiority...”

Clearly, to support U.S. fighting forces today, in 2010, and beyond requires responsive and supportable information technology (IT) systems that can deliver superior communication-command-control-intelligence functions anywhere in the world.

Although the pace of technology has increased, and the threat to the U.S. has changed from a singular, unified set of forces to a continuing set of changing threats originating from individual nations throughout the world, the process for continuing introduction of new technology into military systems has remained consistent. Evolutionary Acquisition, based on fundamental principles of equipment design and manufacture, has become more critical as the pace of change increases.

The EA philosophy and implementation instructions have withstood the test of time. The processes described in this reissue of the 1995 document retain their utility today. Although the references to policy used to support the use of EA in Chapter One have been overtaken by subsequent events, the EA methodology embedded within Chapters Two through Five is unaffected by the fundamental policy changes that have occurred over the past 8 years. Those Chapters need no revision to ensure their currency because they depend upon the unchanging nature of technical (rather than management) process. The reader will find them the same as in the May 1995 documentation.

In this re-issue of the May 1995 document, all of the Chapters have been retained. Although the title of Chapter One has been changed from "Policy Statements About Evolutionary Acquisition" to "Historical Basis for the Genesis of the Evolutionary Acquisition Process," the Chapter is itself unchanged as are Chapters Two through Five. We believe, even more strongly than before, that the EA process which was embodied within the context of the JL-ACTD program will help the acquisition community provide necessary weapon technology to Field Commanders in a timely manner.

The EA concept is no longer simply a viable optional methodology for acquiring new weapon systems. As current events clearly demonstrate, it is perhaps the only mechanism available to achieve and maintain weapon superiority given the rapid pace of technology change and changes in U.S. and world economic and political conditions.

The portion of U.S. industry devoted specifically to serving Defense needs has been shrinking rapidly. Figure i.1 in this foreword traces defense industrial consolidation over the 10-year period from 1985 to 1995. By 1995 only three major U.S. industrial entities remain capable of producing complete weapon systems. Moreover, the emphasis on purchase of COTS in a global marketplace, increasingly dominated by large multi-national suppliers with manufacturing facilities throughout the world, may also pose problems in maintaining defense viability. The Defense Production Act of 1950 (and its subsequent versions as re-enacted from time to time) defines the "U.S. Defense Industrial Base" as all "production facilities in Canada and the U.S., its territories and possessions." But it also contains the caveat: ... "expected to be available in an emergency." It is unclear whether alliances of the kind constructed to pursue military actions in various portions of the world will prove to be stable over the long term. It is also unclear whether commercial manufacturers will continue to manufacture and support products that accommodate a Defense market that accounts for only a small portion of their total revenue – especially if those purchases include special financial disclosure provisions necessary to meet statutory requirements. In the normal course of events, product life-time may not extend beyond 18 months. After that time, new products are marketed and support of older products is phased out.

It may become necessary to use many different kinds of functionally similar products during an extended weapon lifetime. And because of the likelihood that changing alliances may make it necessary to locate suitable sources of supply outside the United States, the reality of the future may require continuously evolving weapon systems in continuing

# U.S. Defense Industry Consolidation

## Boeing

McDonnell Douglas  
Boeing  
ARCO Systems  
UTL Corp.  
Rockwell

## Lockheed Martin

CD Space Systems  
RCA  
CE Aerospace  
Gould Ocean Systems  
Martin Marietta  
Lockheed  
Sanders  
CD Fort Worth  
Loral  
Goodyear Aerospace  
Fairchild Weston  
Honeywell EO  
Ford Aerospace  
Librascope  
LTV Missiles  
IBM Federal Systems  
Unisys Defense

## Raytheon

Alliant Techsystems Division  
Magnavox Electronic  
Systems  
Perkin-Elmer Electro-Optics  
GM-Hughes  
Raytheon  
E-Systems  
HRB Systems  
Texas Instruments Division



Source: McKinney & Company

Figure i.1

use for periods of 40 years or more. Meeting future weapon requirements may only be possible if new weapon systems are designed and built, and existing weapon retrofit is accomplished using EA principles. For these reasons, we again strongly recommend the use of the EA methodology, as the primary alternative rather than as one of a number of secondary acquisition alternatives.

#### Endnotes

[1] *Evolutionary Acquisition: An Alternative Strategy for Acquiring Command and Control (C<sup>2</sup>) Systems*. DSMC Press (March, 1987).

[2] *Joint Logistics Commanders Guidance for Use of Evolutionary Acquisition Strategy to Acquire Weapon Systems*. DSMC Press (May, 1995).

[3] *Acquisition Review Quarterly*. DSMC Press (Summer, 1997).

[4] *Report Of The Quadrennial Defense Review*. William S. Cohen, Secretary of Defense (May, 1997).

Henry C. Alberts  
Fort Belvoir, Virginia  
28 May 1998



# ORIGINAL FOREWORD

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WRIGHT-PATTERSON AFB, OHIO 454333-5001

**DEFENSE LOGISTICS AGENCY  
CAMERON STATION, ALEXANDRIA, VA 22304-6100**

## JOINT LOGISTICS COMMANDERS

### MEMORANDUM FOR ACQUISITION PERSONNEL

SUBJECT: Evolutionary Acquisition Guide

1. This Evolutionary Acquisition Guide was commissioned by the Joint Logistics Commanders and developed under the auspices of the Joint Group on Acquisition Initiatives (JG-AI). The Project team which created the guide was led by the Defense Systems Management College (DSMC) and included representatives from the Services and Defense Logistics Agency (DLA). This guide is one example of DoD streamlining and improvement in the quality of our acquisition policies and processes.

2. We believe this Evolutionary Acquisition Guide will provide Program Managers with a good alternative means to develop and acquire weapon systems while providing for incremental growth in capability overtime. This guide is not and should not be interpreted as a policy mandate, but as a proven technique that may be considered. Use of the techniques recommended in the guide may be tailored as needed for each program.

3. The JLC recommends use of this Guide as a foundation for effective weapon system acquisition planning. If you require additional information on this guide, please contact Mr. Henry Alberts, Chairperson, DSMC Evolutionary Acquisition Team at (703) 805-3464 or DSN 655-3464.

A handwritten signature in black ink, appearing to read "Leon E. Salomon".

LEON E. SALOMON  
General, USA  
Commander  
U.S. Army Materiel Command

A handwritten signature in black ink, appearing to read "James A. Brabham".

JAMES A. BRABHAM  
Lieutenant General, USMC  
Deputy Chief of Staff  
(Installations and Logistics)

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EDWARD M. STRAW  
Vice Admiral, SC, USN  
Director, Defense Logistics Agency

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WILLIAM A. EARNER  
Vice Admiral, USN  
Deputy Chief of Naval Operations  
(Logistics)

A handwritten signature in black ink, appearing to read "Ronald W. Yates".

RONALD W. YATES  
General, USAF  
Commander  
Air Force Materiel Command

Date: 16 Feb 1995



## PREFACE

The environment in which military acquisition occurs has changed since the Joint Logistics Commanders (JLC) Guidance on Evolutionary Acquisition (EA) was first issued. Indeed, the changes are so sweeping that it appears necessary to re-think completely the methodology used to acquire almost all of weapon systems.

The most obvious characteristic of the changed acquisition environment is the absence of a long-term, consistent singular threat, a circumstance which affects the stability of military requirements.

Another change involves the expansion of the civilian marketplace and the effect of that expansion on the pace and condition of technology development. Once, military needs tended to drive technology forward. Increasingly, technology has become responsive to civilian world market forces. In the rapidly advancing technology areas of electronic, computational and information system development, United States military activity provides only a marginal revenue base for its own civilian industrial base.

Prior experience with Command, Control, Communication and Intelligence system acquisition has shown that conventional acquisition strategies often led to unsatisfactory results. The reasons have been defined by many studies. But the principal difficulty with traditional acquisition activities has been that the time required to complete the entire process has lagged well behind changes in requirements and in capabilities provided by technology advances. Environmental changes within which acquisition takes place may have exacerbated previous difficulties in maintaining currency, both in military capability available and in technology used to provide it.

As this guide has been prepared in 1995, a complete review of acquisition policy has been undertaken by the Secretary and Deputy Secretary of Defense, and the office of the Deputy Under Secretary of Defense for Acquisition Reform [DUSD(AR)] was created. The JLC anticipate that the DUSD(AR) will provide necessary change to current acquisition policies.

The JLC offer this updated EA process as a tailored, streamlined acquisition strategy for acquiring weapon systems. The EA process is consistent with current guidance and can help shorten the time between requirement genesis and weapon systems availability. We publish this guide to encourage consideration and use of EA strategy for future weapon systems development when existing weapons are modified to improve their capabilities.

This guide replaces the previous JLC Guidance *Evolutionary Acquisition: An Alternative Strategy for Acquiring Command and Control (C2) Systems* published in March, 1987. It was prepared under the direction of the Commandant, Defense Systems Management College (DSMC) who has also accepted responsibility for keeping this document current.



# HISTORICAL BASIS FOR THE GENESIS OF THE EVOLUTIONARY ACQUISITION PROCESS

## Background

Existing Office of Management and Budget (OMB) and Office of the Secretary of Defense (OSD) policy statements have provided a basis for formalizing acquisition processes used within the Department of Defense (DoD).

OMB Circular A-109 identified seven "Major System Acquisition Objectives." One of those objectives is to:

*"Tailor an acquisition strategy for each program, as soon as the agency decides to solicit alternative system design concepts, that could lead to the acquisition of a new major system and refine the strategy as the program proceeds through the acquisition process..."*

This OMB objective emphasizes the desire to develop a unique strategy for each program. It also implies a requirement to preserve the program manager's (PM) flexibility to act appropriately during the acquisition process.

The DoD 5000 series of Directives (DoDD) and Instructions (DoDI) has been issued to guide Defense Acquisition personnel who engage in major and non-major system acquisitions. The latest revision of DoDD 5000.1, "Defense Acquisition," and DoDI 5000.2 "Defense Acquisition Management Policies and Procedures," furthers this objective by the following statements:

*"Acquisition Strategies and Program Plans. Acquisition strategies and program plans shall be tailored to accomplish established program objectives and to control risk (DoDD 5000.1, Part 1, page 1-4, paragraph C.1). Acquisition Program Content and Tailoring. A primary goal in developing an acquisition strategy shall be to minimize the time it takes to satisfy an identified need consistent with common sense, sound business practice and the provisions of...DoDD 5000.1 and DoDI 5000.2...The number of phases and decision points must be tailored to meet the specific needs of individual programs...Tailoring must be based on objective assessments of a program's status, risks, and the adequacy of proposed risk management plans (DoDI 5000.2, Part 2, page 2-6, paragraph B.5.). Tailoring and Concurrency. The acquisition strategy will be tailored to match the character of the program and allow the most efficient satisfaction of individual program requirements, consistent with the degree of risk involved (DoDI 5000.2, Part 5, Section A, page 5-A-4, paragraph 3.d). Evolutionary Acquisition and Preplanned Product Improvement. Alternative acquisition strategies should be considered for systems where requirements refinements are anticipated or where a technology risk or opportunity discourages immediate implementation of a required capability. Alternative acquisition strategies include evolutionary acquisition and preplanned product improvement. Evolutionary acquisition is an approach in which a core capability is fielded, and the system design*

*has a modular structure and provisions for future upgrades and changes as requirements are refined (DoDI 5000.2, Part 5, Section A, page 5-A-5, paragraph 3.e)."*

Further, the Federal Acquisition Regulation (FAR) and the Defense Federal Acquisition Regulation Supplement (DFARS) provide a discussion of acquisition management principles as information guidance. They support the principles of flexibility, innovativeness, and uniqueness in developing each program's acquisition strategy. The following discussion from Defense Acquisition Circular 76-43, "Acquisition Management and System Design Principles," published on February 28, 1983, exemplifies these acquisition management principles:

#### *"6. Acquisition Strategy*

*a. An initial program strategy will be developed by the DoD Component concerned for each major system acquisition when a new start is proposed. The acquisition strategy should be tailored to the unique circumstance of the program. Proposed exceptions to applicable DoD Directives and Instructions will be identified in the acquisition strategy as it evolves. Advice and assistance should be sought from business and technical advisors and experienced managers of other major system programs.*

*b. The acquisition strategy is the conceptual basis of the overall plan that a program manager follows in program execution. It reflects the management concepts that will be used in directing and controlling all elements of the acquisition to achieve specific goals and objectives of the program and to ensure that the new system satisfies the approved mission need. The acquisition strategy encompasses the entire acquisition process of the basic system, preplanned product improvements (P<sup>3</sup>I), and post production support. The strategy must be developed to sufficient detail, at the time of issuing*

*solicitations for the concept exploration phase, to permit competitive exploration of alternative system design concepts. Sufficient planning must be accomplished for succeeding program phases, that involve design, competition provisioning and support economies, and production source availability.*

*c. The acquisition strategy must evolve through an iterative process and become increasingly definitive in describing the interrelationship of the management, technical, business, resource, force structure, support testing, equipment standardization, and other aspects of the program. Normally, the baselining and definition of a program will progress from establishment of operational requirements....to a functional baseline (Milestone I) to an allocated baseline (Milestone II) to a product baseline (Milestone III).*

*d. Acquisition programs will be executed with innovation and common sense. The flexibility inherent in DoDD 5000.1 and DoDI 5000.2 will be used to tailor an acquisition strategy to accommodate the unique aspects of a particular program, as long as the strategy remains consistent with the basic logic for system acquisition problem solving and good business management principles."*

Moreover, in support of this general guidance, DoDI 5000.2 specifically calls for consideration of "Evolutionary Development and Acquisition of Command and Control Systems," and generally recognizes that Command, Control and Communication (C<sup>3</sup>I) systems generally require Evolutionary Acquisition (EA).

The Joint Logistics Commanders (JLC) have endorsed the OMB and OSD guidance in a previous issue of this document. Now, given the magnitude of change to the world political and military condition and the reduced need for active military forces that those changes generated, the

JLC believe a review of the principles of EA is in order to evaluate the potential value evolutionary processes might have when used for other than C<sup>3</sup>I systems.

This document extends the application of EA processes beyond C<sup>3</sup>I systems: it provides new guidance about how EA processes can be used to focus more clearly on the development of necessary military equipment and the systems which support our field commanders and their personnel. It does this in the succeeding 4 Sections:

Section 2 - An Overview of Evolutionary Acquisition,

Section 3 - Characteristics Which Indicate Consideration of an Alternative Acquisition Strategy,

Section 4 - Adopting An Acquisition Strategy which Accommodates Change, and

Section 5 - Guidelines for Preparing the Acquisition Strategy Report for an Evolutionary Acquisition.

Use of any acquisition process demands that all personnel associated with the program provide their full support and cooperation in formulating and executing the

selected strategy. This is especially true when the strategy involves accelerated acquisition and program risk shifts.

An EA program may involve a number of individuals and organizations outside those reporting to the JLC, and the support of these persons and groups will be crucial to program success. The JLC urge all organizations and individuals within them who are involved in acquisition processes become familiar with the principles, advantages and potential pitfalls which may accompany the use of the EA processes outlined in this guide.

Establishing effective patterns of interaction with external organizations involved in EA processes may be difficult: use of EA will require review of, and perhaps modification to, established relationships between those organizational entities involved. The JLC will, if necessary, assist subordinate commanders and their PMs in their efforts to achieve effective patterns of interaction with organizational entities involved.

Choosing an appropriate acquisition strategy, whether it be evolutionary or any other kind, will not by itself ensure a successful program. Rather, excellence of management and strong support of all who are involved are additional conditions essential to success.

# 2

## AN OVERVIEW OF EVOLUTIONARY ACQUISITION

### Background Studies

Two major studies<sup>1</sup> of past Command and Control systems have found that the use of standard acquisition approaches described in detail in Department of Defense Directives (DoDD) and Instructions (DoDI) have often had unsatisfactory results.

The systems considered in these studies were large, software dominated information systems intended to aid operational commanders in performing their command and control functions.

Difficulties arose primarily because, especially for command and control systems, it was often impossible to define detailed operational capabilities or functional characteristics for the complete system before undertaking full scale development, now called Engineering and Manufacturing Development (EMD).

Studies currently underway<sup>2</sup> have examined the acquisition environment likely to emerge from changed threat perception, rapid world economic change and its associated technological advances and realignments. It appears that rapid change to

most elements which affect the acquisition process environment will preclude those long periods of stability necessary to develop clear definition of system operational concepts, capabilities and functional characteristics prior to entering EMD. This implies the extension of Evolutionary Acquisition (EA) processes to systems other than C<sup>3</sup>I.

Whenever EMD of any complete system is begun without clear definition of system operational concepts, capabilities and functional characteristics; it is very likely that the development process will be long, costly and unstable. The developed system will then be unsatisfactory and logistically unsupportable.

Recent changes in world conditions have materially affected the environment in which defense acquisitions will take place:

- The former emphasis on a European continental threat, the Soviet Union, has been replaced by multiple and constantly changing threats in terms of both threat location and the weapons adversaries might use.

---

<sup>1</sup>. "Report of the Defense Science Board Task Force on Command and Control Systems Management", July 1978, Office of the Under Secretary of Defense Research and Engineering, Washington D.C. and "Command and Control (C<sup>2</sup>) Systems Acquisition Study Final Report", September 1, 1982, The Armed Forces Communications and Electronics Association, Falls Church, Virginia.

<sup>2</sup>. Studies in progress: Armed Forces Communication and Electronic Association and Defense Systems Management College.

- In a fiscally constrained economy it is likely that new system starts will be few, modifications to current systems will be the norm, and use of non-developmental items (NDIs) will be emphasized.
- A shortened period of technological advances, and ready market availability of commercial off-the-shelf (COTS) components, changes the potential to make performance trade-offs and provides opportunities to achieve cost effectiveness and schedule improvements. Under such circumstances, defense systems advances may likely be incremental rather than generational: improvements in efficiency and effectiveness of existing systems more than their total replacement by entirely new platforms and tightly integrated equipment.

The ability to respond to change has become an important element of Defense System Acquisition Strategy. The above studies all have recommended the use of an EA strategy to permit orderly, timely and efficient development of effective defense systems for the type of environment in which new defense acquisitions will be operated and maintained.

### Evolutionary Acquisition (EA) Defined

The EA process is defined as follows:

*A strategy for use when it is anticipated that achieving the desired overall capability will require the system to evolve during development, manufacture or deployment.*

Among categories of factors which influence EA are requirements uncertainties, technical uncertainties, funding availability, schedule problems, interoperability and commonality requirements, the need in some kinds of systems for continuous user involvement, and instabilities due to environment. An evolutionary process may be especially effective when change to any of these factors is likely during the time period of system development.

The major approach which underlies EA is encouraging early fielding of a well defined core capability in response to a validated requirement. This, while planning actions which will, within an approved architectural framework, enhance that core and ultimately provide a complete system with the required overall capabilities. Senior leadership must be actively involved in such a strategy.

Each incremental capability to be acquired is treated as a tailored individual acquisition. Scope and content result from both continuous feedback from the developer, independent testing agencies, the user (operating forces) and supporting organizations; and application of desirable technology within the constraints of time, requirements, cost and risk.

Characteristics of EA are:

- A general description of the functional capability desired for the full system.<sup>3</sup>
- A concise statement of operational concepts for the full system.
- A flexible, well-planned overall architecture,<sup>4</sup> to include process for change,

<sup>3</sup> The lack of specificity and detail in identifying the final system capability distinguishes EA from other incremental strategies.

<sup>4</sup> The system architecture defines the partitioning of system components, flow of data, flow of control, timing, and throughput relationships, interface layering and protocol standards. A flexible architecture requires long-term tolerance to change. (See "A New Process for Acquiring Software Architecture", by Thomas F. Saunders, Dr. Barry H. Horowitz, Matt L. Mleziva, M92B0000126 The MITRE Corporation, November 1992.)

which will allow the system to be designed and implemented in an incremental way with minimum regression testing. Recent advances in open systems and domain architectures are enabling change at reasonable cost and impact.

- A plan for incrementally achieving the desired total capability which adheres to life-cycle cost effectiveness.
- Early definition, funding, development, testing, fielding, supporting and operational evaluation of an initial increment of operational capability.
- Continual dialogue and feedback among users, developers, supporters and testers.

The kinds of uncertainties which preclude detailed planning and the degree of user or developer involvement required during the evolutionary process determine which major classes of EA best fit any particular program. These kinds of uncertainties also determine how incremental (evolutionary) acquisition, which was previously called Pre-Planned Product Improvement (P<sup>3</sup>I), will be managed in each class.

- The first EA class is characterized by requirements which are certain to change, are large in scope (such as are encountered in the development of new command and control systems);
- The second EA class is characterized by technological uncertainties (such

as are encountered in new sensor and weapon systems); and

- The third EA class is characterized by planning, programming and budgeting (PPBS) uncertainties (such as cost, schedule, budgeting and logistics).

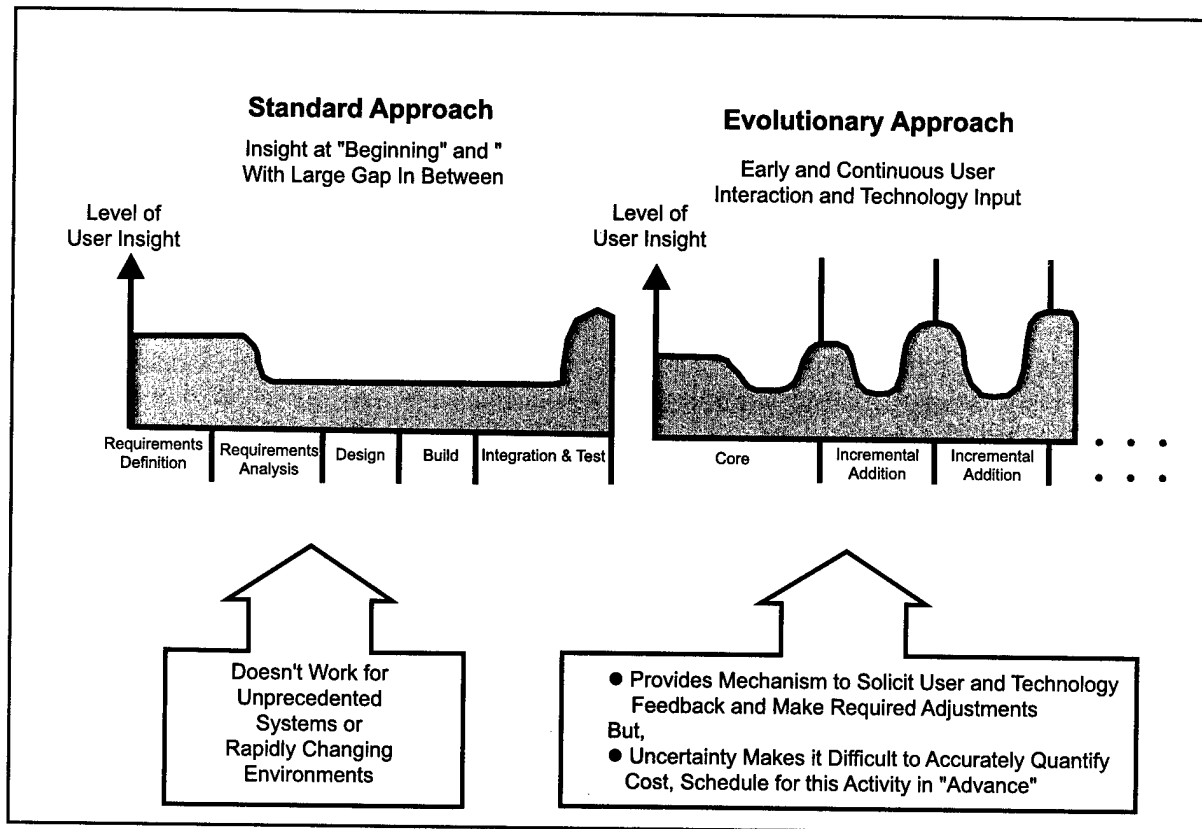
### Successful Evolutionary Acquisition

Executing EA programs successfully will require some change in relationships among the various agencies involved in the acquisition process, and practices used under conditions of long-term stability. An important change is the need for much closer interactive relationships among:

- forces in the field (commanders and individual troops), and the user representatives (operators and maintainers) during system design and development;
- independent testers (who will ensure testability of the system and all its elements as capabilities are continuously enhanced);
- developer (including Industry); and
- PPBS that must react more quickly to the changing fiscal requirements implicit in the EA process.

*A primary requisite for successful EA is recognition of the need to develop strategies which facilitate change.*

The chapters which follow will detail changes in current practice and provide guidance on how they might be achieved.



**Figure 2-1. Evolutionary Acquisition Overview**

# 3

## CHARACTERISTICS WHICH INDICATE CONSIDERATION OF AN ALTERNATIVE ACQUISITION STRATEGY

### Background

To help develop factors which indicate a need to consider alternative acquisition strategies, a group of very experienced acquisition managers was asked to respond to the question *"What are the factors which would cause you to select a particular Acquisition strategy?"*

Factors were identified in six (6) categories of equal importance, which they believed would affect the choice of an acquisition strategy. The factor categories were:

### Requirements

- Are there uncertainties about requirement stability or requirement details? Are requirements likely to evolve, grow or change because of
  - > an evolving threat or change to projected battle environments,
  - > an uncertain operational concept,
  - > uncertainty in the final capability to be achieved, or
  - > change to the objectives or goals to be met?
- Are there size and complexity uncertainties?
- Has the requirement been well communicated?
- Is user feedback during development necessary to "tune" final requirements?

### Technology

- What are the technology states of the art? What states of the art and of practice are required? What technical innovations will be necessary?
- What is the foreseeable time-line of technological change? How uncertain is the technology (how unstable is it and what changes in technological opportunities are likely)? What are the maturities of the required technology infrastructures? And, what is known about achievable trade-off bases?
- Are there uncertainties in the performance characteristics required? What is the pattern of system functional interfaces? Must the system architecture support system performance growth and must the system be scalable?
- How available are test and support assets?
- Is the system "software dominated?"

### User Involvement

- How many users are there and what are the characteristics of the user groups?
- Is there likely to be a change in the composition of "users?"

- What degree of user involvement is "necessary" and how much user feedback is essential?

### **Schedule**

- What is the user's time-line?
- Is there urgency in the schedule (is something urgently needed in the field)? How urgently is a short-term capability required? Are there problems or uncertainties in meeting the schedule? Is the Initial Operating Capability firm or is there need to consider systems growth from the program's outset?
- Are schedule instabilities inherent in the program?

### **Funding**

- Are there budget uncertainties (instabilities) regarding near- and long-term funding requirements, funding types and availabilities?
- Is it likely that implementation cost assumptions are unstable? Are there uncertainties or problems in likely cost or affordability? Are cost and schedule realism firmly in hand?
- Is the likely size of the buy fixed? Would changed quantities result in changed affordability?

### **Other Constraints**

- What systems are being replaced? What is the status of other affected programs? Is there a need to reengineer or upgrade older systems?
- What commonalities and interoperabilities with other systems are necessary and what is their maturity?

- What interfaces are there with other agencies and concepts? What support agencies and concepts interface with the system? What requirements are there for capability to repair or change the fielded system?
- Is there existing or modifiable commercial capability? Are there Non-Developmental Item (NDI) components commercially available? Are there commercial sources for components or equipment?
- Is incremental development indicated because of likely instabilities in the requirements, environment or technologies available during the planned developmental program?

Review of the factor categories indicated that some key conditions appeared to exert major influence on the acquisition strategy selection. They were:

### **Uncertainty**

There may be changes to the factor categories during the period of system development and use, which might force change in system design in order to achieve performance or other objectives; or there is uncertainty about how exactly to apply current knowledge to achieve system integrity; or both.<sup>1</sup>

### **Lack of Knowledge**

There are no ready mechanisms (techniques, processes, infrastructures, data) available in one or more factor categories to permit achievement of all desired system capabilities. This situation is very likely to change during the period of system development; or some new mecha-

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<sup>1</sup> A circumstance which can be paraphrased as: "We know *how* to do what is necessary in general, but we are unsure how to apply it to the job at hand, and we do not know if the circumstances of applying that knowledge will change during the life of the development and use."

nisms will need to be devised; or changes in circumstance of system usage will change the way in which existing or developing mechanisms can be applied.<sup>2</sup>

### Omens of Change

There is reason to believe that change to the factors will occur in a time frame shorter than the system development process requires. Because those changes would affect system architecture as well as the system capability (each might need to evolve) they must be considered in formulating an acquisition strategy.<sup>3</sup>

The major reason to select an alternative acquisition development strategy versus a classical development strategy is the need to accommodate *continuous change* that results from the major influences enumerated above.

### Review of Weapon Systems Characteristics

Given an acquisition environment characterized by uncertainty in requirements and technology, it is unlikely that details of weapon systems development activity can be defined in detail very far in advance of the required activity. Even system design and interface specifications with other systems, also under development, will require redefinition as responses to changed situations are recognized.

Moreover, development programs which seek to improve existing weapon systems capabilities will display characteristics normally associated with shorter term sequential, incremental product development activity, rather than those associated with the

long-term generational weapon system developments which dominated past acquisition activities.

For these reasons, alternative approaches to weapon systems development may become the preferred methodology for many kinds of acquisitions. Specifically, systems which are characterized by one or more of the following statements are candidate systems for alternative acquisition:

- Supports a unified or specified command which connects with higher, lower and collateral commands as part of an uncertain interoperability relationship/requirement, or is required for interoperability with multi-service or multi-national systems that are nonstandard or under development.
- Fulfills one or more operational missions or part of an overarching doctrine or strategy that is under revision or in a state of flux.
- Is tightly coupled with particular operational settings and thus aligned with specific geographical parameters, ranges of threats, and/or specific doctrines.
- Meets the specific needs and desires of specific individual operational commanders.
- Is highly adaptable to meet the many demands a commander can place upon them under the wide range of circumstances inherent in a battle-field environment.
- Has limited access after deployment (e.g., satellite systems).
- Will require continuing research and development after deployment to overcome technological shortfalls.

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<sup>2</sup> A situation which might be paraphrased as: "We know what to do to achieve success, but not how to do it."

<sup>3</sup> A situation which might be summarized as: "We know what to do, but we expect that to change during the time we are in the process of doing it."

- Are vulnerable to evolving counter-measures.
- Is primarily command, control and communication (C<sup>3</sup>I) system developed to assist operational commanders understand and communicate information concerning hostile and friendly forces, select an effective course of action, and monitor execution of the implementing operational orders.
- Is computer-software dominant.
- When only one system is required.
- Performs acceptably with imperfect information, and performance should degrade gradually rather than catastrophically when damaged or stressed beyond design limitations.

The activities and actions required for successful EA are described in the next section.

*Despite the uncertainties that characterize a program utilizing an alternative approach, it is of paramount importance that each design increment be preceded by a complete, and unambiguous articulation of system requirements for that particular increment. Additionally, an adequate understanding of the "final" system's capability must be known in order to provide for incremental designs that will allow future enhancements without negating previous design efforts (see Chapter 4). If either of these components are lacking, then acquisition design initiation should not proceed.*

## ADOPTING AN ACQUISITION STRATEGY WHICH ACCOMMODATES CHANGE

### Activities and Actions Required to Implement Evolutionary Acquisition (EA) Approaches

Most future defense acquisitions will need to account for and facilitate change. Executing a strategy which can deal with uncertainty and is appropriate for periods of widespread change will require adjustments to:

- Relationships between participants in the acquisition process;
- Management procedures and documents; and
- Tailoring the strategy to the type of system (C<sup>2</sup>, weapon, administrative, etc.) acquired.

Such adjustments will provide

- Flexibility necessary for adequate response to requirements changes, resulting from learning that occurs during the development process;
- For rapid progress through the various steps in the acquisition process as each system capability increment is developed;
- Sound technical bases which encourage incremental equipment capability upgrade to exploit innovative new technologies and increasingly sophisticated and reliable commercial off-the-shelf (COTS), and reusable, systems and system

components, without excessive time penalties associated with rework and regression testing; and

- For robust system interfaces configured to permit continued system interconnection and data exchange among specified systems as they evolve.

To permit appropriate exercise of management oversight, all changes to present relationships and practices must be taken openly. In particular, changed procedures and relationships still must facilitate control of requirements growth, assure timely delivery of required capabilities, provide for necessary operational testing, and allow for competition among qualified suppliers.

Approaches to EA heighten (rather than obviate) the need for early program planning and for technical and support engineering activity. Clearly, the organic and commercial logistics support infrastructure, which is also evolving, must be considered so that both initial capabilities and subsequent increments can be cost-effectively supported, to the levels of performance specified, beginning at introduction. Requirements definition, technology and threat forecasting, system architectural

planning, and funding availability prospects over an extended program development life span are all necessary to set the framework of acquisition.

Key areas where changes to present practice are required are discussed below.

### **Relationships Among the Acquisition Executive, User and User Surrogate, Developer and Tester**

Relationships among the major entities may be rather formal in conventional acquisition programs. Negotiations between them may be conducted at arm's length. The roles of each participant need redefinition and adjustment to achieve a successful EA. Closer, more cooperative relationships will be needed to achieve necessary harmony in five areas:

1. **System Operational Capabilities:** In conventional system acquisition, a surrogate user frequently assumes the primary role in specifying desired system operational requirements. Depending on individual service procedures, the primary field user may be removed from the acquisition process. When EA processes are used to acquire systems characterized by requirements uncertainties, or which are unprecedented, a major premise is that the field user plays the major role in formulating operational requirements and in defining detailed system characteristics when operational requirements have been defined. Each program will need to define suitable roles for all participants. Individual roles among participants can become quite complex, especially when users are members of a Service different from that of the developer. Because relationships are critical to

program success, they should be suitably formalized by Memoranda of Understanding or Agreement.

2. **Operational Test and Evaluation:** A key premise in EA processes is that systems tests are made incrementally on each element of system capability. Initial testing is accomplished on the first incremental system configuration and involves an investigation of architecture growth capability; testing continues on subsequent configurations as they become available. The tests determine whether the system, as configured, meets the operational requirements the user has specified.

Each Service has an organization responsible for independent operational test and evaluation. When the user operates a system, that user becomes a critical part of the total system and greatly influences its performance. When independent testers perform tests with user groups, not only are test results more likely to represent real capabilities, but both the user and the developer gain understanding of the system capabilities. That shared information is critical to validating (or redefining) operational requirements for those system increments which are to follow.

Because the operational tests are so important in the process of evolving requirements and introducing increments of system operating improvements, which distinguishes evolutionary approaches from more classical weapon systems acquisition processes, it is imperative that operational testers and evaluators become deeply involved early and maintain continuous direct liaison with developer and user. Early, continuous involvement

facilitates integrated, appropriate, and timely operational testing essential to successful system development.

In conventional acquisition processes, developers and users may have less frequent interaction during the development process than during EA processes. Each EA process depends on just such close and continued interaction. Developers, users and those who will support the system when deployed must work closely together over the course of the development activity. For systems with requirements uncertainties, provision for user prototypes and testing at beta sites should be included within the acquisition strategy.

Use of EA approaches is likely to make necessary some redefinition of the process of operational testing and evaluation. Specifically, there may be an increased use of contractor testing, especially for systems which are software intensive. This issue must be addressed in the Test and Evaluation Master Plan at program inception. The objective of operational test and evaluation should be to exploit integrated testing without loss of critical independence of contractor/developer/user perspective and their subsequent input to the ongoing development process.

**3. Program Review and Approval:** In conventional acquisition there are only a few instances (normally at major program milestones) when a program manager (PM) is required to gain decision authority approval to proceed. The EA processes might require milestone decision authority approval for each increment of capability, perhaps at each of several

stages in the development program. Use of EA processes will require considerable streamlining of the approval process. For some programs, when a final configuration can be defined in detail, the total system might be validated as one requirement and each increment treated as a "release," provided the program performance and cost thresholds are maintained.

**4. Program Management:** In conventional acquisition, a program office is frequently established only after considerable preliminary planning has been completed and the program is really underway. Under such circumstances, it may not be possible to begin the program with the numbers of experienced staff at desirable levels of expertise. Use of EA demands that a fully capable program office be established very early because:

- the acquisition strategy must be defined early,
- the roles of, and relationships between, the key stakeholders must be negotiated early,
- the program sponsor will need program office support in defining the fundamental architecture and support structure which underlies the complete system, and
- early delivery of a core capability and early feedback on its performance are required.

Another consideration: the program office must generally be staffed more heavily to allow it to manage all phases of the acquisition cycle concurrently, since using an evolutionary process may find several increments, in different stages of acquisition, under development at any one time.

**5. Competition in Contracting:** Use of EA requires consideration of four closely related areas of work - system architecture; developing and maintaining off-line development, test and support facilities; system configuration management; and logistic support. These areas of work may continue not only throughout acquisition but also throughout the systems useful lifetime, since the system will continue to evolve through use experience. Because it is important that continuity be maintained in each of these functional areas, either the functions must be provided directly by the government, or any contractor performing a function must be retained for some number of years. While contractors can be changed occasionally without undue program impact, frequent change in responsible agent or staff will likely be highly disruptive<sup>1</sup>.

The task of developing operational applications utilizing the system architecture as part of each increment to the system operational capability should not be significantly affected by change in management or staff. The inefficiencies of new contractors learning the system should be ameliorated by a flexible system architecture which increases positive effects of competition.

### **Changes to Current Management Procedures and Documents**

#### ***System Planning and System Architecture***

Significant effort is required early in the program to permit adopting a strategy

which accommodates change. It will be necessary to analyze and explore the likely directions of change over the life of the program; although omniscience is unlikely, reasonable understanding can be gained of likely directions for change in threat, operational employment and deployment, technological evolution and the likely availability of suitable commercial products, and development of interface standards and funds. All of these elements are essential to structure the content of acquisition increments, the pace of progress, and to select an architectural framework which facilitates evolving the system capabilities over the life of the program.

Recent developments<sup>2</sup> offer increased potential to exploit technological innovation and COTS products, thus making competition easier and potentially very productive. The choice of architecture is a crucial issue. It must be tailored to the problem and mission domains but also provide for the most likely sets of change.<sup>3</sup> That is, the development process needs to incorporate the means for changing, i.e., evolving, the system architecture itself over the life of the program.

In addition to data processing and information exchange architectures, a plan is required to ease platform installation and modification and thus facilitate the capability for a system to evolve over its life cycle.

#### ***Control and Stability of the Development Process***

Proper process control must be provided for in EA processes. It is important to define precisely the developmental increments and what system performance they

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<sup>1</sup> It may be preferable for the government to perform the functions with in-house government staff.

<sup>2</sup> Some of these developments are: layered architectures, formal specification languages, open bus and network interconnection techniques and standards, fourth generation computer languages and object oriented design.

<sup>3</sup> We are not able to design a single architecture to accommodate all types of change over extended period of time.

will achieve. Doing so will provide a basis for review of changing functional requirements that appear during the development process. Change to functional requirements (especially additions to current requirements) can be controlled by accepting only very important changes. The philosophy of permitting only crucial requirement changes is essential because:

Feedback on effectiveness and suitability from actual operations and maintenance is almost always required to determine the value of proposed changes with any degree of certainty. For programs with short times between development increments, deferring requirements changes until the next program increment might be a better course of action because it preserves schedule and does not place delivery and fielding plans at risk. However, preserving schedule is of little value if feedback indicates an inability to meet or sustain specified performance thresholds or a lack of logistics supportability.

When users can identify frequently changing requirements, then EA may be an appropriate strategy if multiple configurations can be managed and supported. Evolutionary processes provide for later stages, when such changes can be incorporated if still required.

The need to manage requirements changes is perhaps greatest when change affects software in development. It is often possible to effect a performance change through a change to the system software. There is a widely held belief that software changes are easy to accomplish, and that a change in requirements results in only minor software modification.<sup>4</sup> In reality, the

further along the development process is, the more difficult it is to make software changes. Detecting errors in program function, caused by modification to program codes, becomes much more difficult as individual software programs are joined with each other through a series of integration tests. Because the functional implications of even small program change can be vast, the cost of making them increases as the development process proceeds.<sup>5</sup> More robust architectures may reduce these costs but sufficient time for design and test must be provided to avoid later problems. Experience shows that a lack of tight software configuration control produces extreme difficulty in both testing and in-service use.

For these reasons, any change in functional requirements must be assessed carefully to define how it will affect on-going development activities.

### *Configuration Management, and Documentation of System Design*

Configuration management planning and full system design documentation are important for any acquisition process. In an evolutionary process, careful attention to evolving architecture and a series of system increments are of paramount importance. For example, managing the configuration is increasingly complicated and costly when both past and present evolutionary increments are being operated and maintained to any extent with separate personnel skill levels, unique tools and technical data (including training and repair manuals and software), different repair facilities among contractors and organic sites, and varied provisioning needs. The technical data package is the key to

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<sup>4</sup> Misconceptions which can be reinforced by programmers' optimistic response to management suggestions.

<sup>5</sup> As a rule of thumb, adding a small additional capability through software change when the development cycle is well developed will likely cost ten times the amount such a change would cost if it were accommodated at the start of the succeeding developmental increment.

disciplined documentation. It is essential that documentation be comprehensive and complete. The following specific activities impact on configuration management.

**1. Production and Installation:** When EA processes are used for any sort of defense systems, primary attention is normally focused on architecture, requirements, development, integration and evaluation. When hardware is to be evolved, the time between hardware increments may be long (2 to 3 years). If the number of systems is large, the installation is complex (such as in aircraft and missiles), or re-qualification is required, then the length of time and complexity of the system integration and modification makes configuration management more difficult.

In contrast, many large and complex C<sup>2</sup> systems are few in number or even "one-of-a-kind." In such cases the time between system evolutionary increments may be shortened with only small impact on configuration management and installation. Installing<sup>6</sup> software (exclusive of software integration and test activities) is generally also simpler: it involves primarily the reading of digital data from a magnetic tape or disk into a computer's internal memory. Thus, software production and distribution cost are significantly less than its development.

When many systems are involved, provisions for interfacing systems of differing capabilities are necessary and more care is required in configuration management.

**2. Software Maintenance and Control:** Maintenance of hardware consists largely of four kinds of actions taken to:

- determine whether it is functioning properly,
- prevent component wear-out,
- correct for deviations in system component functional characteristics ("drift"), and
- repair or replace components which are badly worn or have failed.

Software and hardware maintenance differ in a number of ways. Since software does not "drift," wear out, burn out or break, it will not require the kind of maintenance described above. But software *does* malfunction: most often when the system within which it is embedded experiences conditions which produce combinations of software inputs that had not been considered during the testing process.<sup>7</sup>

Because software maintenance results in change to software functional performance, it is imperative to observe proper configuration management procedures during the maintenance process, including appropriate revision to systems documentation (technical data package). This must be done for every software increment that is approved for routine field use.

### *The Acquisition Strategy*

Special emphasis should be placed on development of an acquisition strategy to provide early address of procurement lead time constraints.

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<sup>6</sup> Installation includes testing to ensure software was installed correctly.

<sup>7</sup> Software test data are normally derived from consideration of system operating envelopes within specific operating environments. When either environment changes, or system operational envelopes are exceeded, software functional integrity may not be sustained.

The EA strategy should include the following elements thought necessary to ensure program success:

1. **An Evolution Plan:** An outline of the projected incremental allocation of capabilities and a time frame for their implementation. Included should be a time phased description of system interfaces, a guide for operational test planning and a basis for negotiating shared development and support responsibilities.
2. **An Architectural Plan:** A description of the principles on which the system architecture is based and the kinds of change that architecture can facilitate. It should include a set of guiding principles for management, development and maintenance; and an outline of how the architecture is expected to be improved in the future.
3. **A Technology Road Map:** A schedule for the availability of technology developments which relate to the system under development. This should include a survey of COTS products and a projected schedule for maturing emerging technologies.
4. **A Funding Profile and Contract Strategy:** A summary of the funding requirements for each incremental development, at least for the first increment. A contract strategy should be selected which tailors existing contract practice to the needs and structure of the evolving program. Early planning will also provide maximum opportunity to insure effective competition practice.

It may be useful to include a two phased approach in the acquisition plan to facilitate competitive benefits.

- The first phase would involve mul-

multiple awards with resulting contracts addressing the initial (or core) capability. Potential teaming arrangements would be indicated. Conceptual segments and approaches to incremental system performance improvement would be prepared and system specifications prepared at this time. In some cases, the plan might even provide for deliverable demonstration models.

- The second phase would involve selection of a contractor for system integration. Competition would be preserved at the second tier for each individual system increment development.

5. **A Product Assurance Plan:** Solid product assurance planning must link all aspects and phases of the system and be visible at decision milestones. Such planning should recognize specifically that in an evolutionary program, the developer's responsibility must extend through user fielded verification which might entail special maintenance or warranty provisions.

6. **Integrated Logistic Support (ILS) Planning:** Support planning and analysis serves three purposes:

- First, it determines the minimum investment in logistics support assets for the COTS core capability.
- Second, it ensures that the evolving design concurrently pursues, and meets, both technical and support performance requirements.
- Third, it tailors an optimal support program to sustain and measure performance over the expected service life.

Early support planning allows for more

realistic program funding and scheduling profiles, for a smooth insertion of the system into the current organic support infrastructure (if appropriate), for configuration control of the various (overlapping) increments, and for the feedback needed to drive subsequent evolutions.

Although additional time might be necessary to prepare a thorough, comprehensive Acquisition Strategy at the outset, doing so will tend to facilitate a smooth transition from phase to phase (capability to capability). It will also provide for much greater accountability and increase confidence that the desired final system capability can be achieved.

### Tailoring the Acquisition Approach

Just as DoDI 5000.2 encourages acquisition strategy tailoring, the EA approach may also be tailored:

- to the degree of user and developer knowledge and involvement required,
- to requirements, PPBS needs, or technological uncertainties,
- to the degree of advanced development required, and
- to opportunities for use of off-the shelf commercial or military components.

Figure 4.1 displays the tailoring concepts graphically.

The extent of user and developer involvement in the EA process varies according to the kind of system being acquired.

### Tailoring Guidelines

The activities and relationships required to accomplish EA successfully should be tailored by system type and the relative im-

portance of all the associated factors.

For example, where heavy user involvement is indicated, the time between increments should be short (6 months to 1 year) to provide for user feedback. When there is technological uncertainty, time and resources for advanced development may be required. Prototyping at user facilities may be required to resolve requirement uncertainties. There is more potential for use of non-developmental items (NDI) and COTS in administrative and support systems. For sensor and weapon systems, most of the desired system capabilities involve tailoring system components to the physical and electromagnetic operational environments.<sup>8</sup> The detailed knowledge and experience required to do that are likely to reside with the developer.

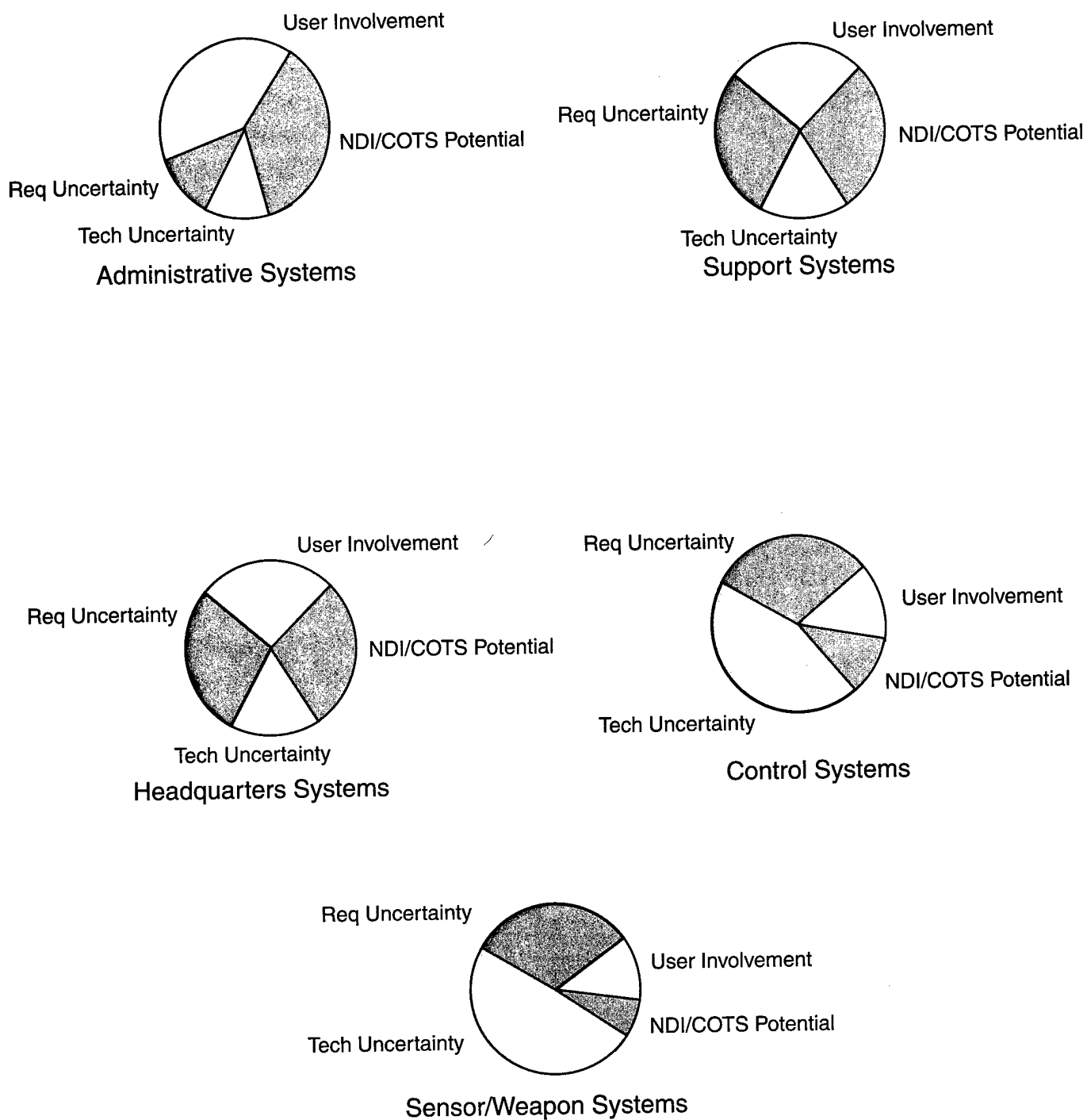
For headquarters-type command systems, the major capabilities required are generally in the form of management and decision aids and must be tailored to the command tactics, procedures and operational style. The required experience and discipline to define capabilities for these kinds of systems generally are found in the system's ultimate users.

*"When there are requirements uncertainties an evolutionary approach is generally adopted because it has to be. In such cases, a kind of "design-and-try-out" approach must be taken to both the need and the approach to satisfying it. Some other situations which are likely to drive the choice of an EA process are:*

- (a) difficulty in stating requirements adequately at the beginning of true C<sup>2</sup> like programs,*
- (b) requirements are expected to change frequently over the life of the program, or*
- (c) users cannot specify acceptability criteria*

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<sup>8</sup> Technically such capabilities are usually provided in the form of control and feedback loops.



**Figure 4-1. Tailoring the Acquisition Approach**

**Factor Relative Importance as a Function of the Type of System Being Developed**

adequately in advance due to their subjective nature.

*"In contrast, when there are technological uncertainties, an evolutionary approach may be adopted for any one of a number of reasons even when what is wanted can be rather precisely defined, and achieving the desired end objective can be more objectively measured.*

*"When requirements uncertainty indicates an EA approach, the program may involve little or no advanced development.<sup>9</sup> In contrast, when technological uncertainty indicates an evolutionary approach, significant amounts of advanced development are ordinarily involved. Indeed, the evolutionary strategy has been derived as a means of dealing with just such uncertainties because development periods involved in making very large or "revolutionary" jumps at the limits of a state-of-the-art take so long and are so risky that U.S. readiness is being threatened.*

*"While it is highly desirable that users be constantly knowledgeable about programs with technological uncertainty — indeed play a continuous, if reactive role in the acquisition of any DoD system — the approach for these programs does not require user acceptance of any significant responsibility at any stage of the acquisition cycle. In contrast, for programs with require-*

*ments uncertainty, succeeding blocks of work after the first cannot be adequately specified until feedback from some user is received on the usefulness and needed modifications to prior blocks."<sup>10</sup>*

In the latter case the time between increments must be kept small (6 months to 1 year) and it may be desirable for the user to beta test prototypes of upcoming increments to assure continuous user input to the evolving development process. Where the choice of an evolutionary approach is driven by technological uncertainty or funding and schedule considerations, the time between increments may be longer and tailored to expected availability of new techniques or funding.

As we move from the more physically constrained, high technology sensor or weapon systems to the inventory or payroll systems which support the administrative needs of the commands, the chances increase for the exploitation of COTS or NDI components.

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<sup>9</sup> For example, when a user upgrades his C<sup>2</sup> capability using existing commercial or military materiel.

<sup>10</sup> The quotation is taken *verbatim* from the AFCEA Final Report referenced in Chapter 2, Footnote 1.

# 5

## GUIDELINES FOR PREPARING THE ACQUISITION STRATEGY REPORT FOR AN EVOLUTIONARY ACQUISITION

### Background

A survey<sup>1</sup> of 6 C<sup>3</sup>I Program Managers (PMs) provided insight into a workable mechanism for achieving authorization to pursue an evolutionary acquisition (EA) strategy. Each manager indicated a plan to use EA as the strategy in the program Acquisition Strategy Report.

What follows in this chapter is a set of Guidelines for preparing the Acquisition Strategy Report. Annotations have been added to indicate references to the EA option permitted in the various policy documents cited in Section 1.

The following guidelines are keyed to appropriate portions of the acquisition strategy report. Each major section and paragraph of the report is discussed.

### *Section A: Program Structure*

1.0 Define relationships between the following items:

1.1 Acquisition Phases: In addition to the acquisition phases, describe the options set forth in previous Program Memoranda and delineate EA as the option the acquisition strategy supports.

1.2 Decision Milestones: The plan must identify decision milestones that are necessary to permit the acquisition strategy to succeed. The plan should address all the technical, business, management and other significant considerations which will control the acquisition. An Evolution Plan should be included outlining projected incremental allocation of capabilities and a time frame for their implementation. It should present a time-phased description of system interfaces, a guide for operational testing, and a basis for negotiating shared development and support activities. Although the content of each plan will vary depending upon the nature and circumstances of the particular acquisition, the planner should follow the instructions in the Federal Acquisition Regulation (FAR) Part 7, Subpart 7.1, Paragraph 7.105 together with any specific Service implementing procedures.

1.3 Solicitations: Address at least the following steps (and any others which are appropriate):

- Acquisition Plan approval. Indicate when plan updates will be accomplished. Updates should be

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<sup>1</sup> See the discussion within the Armed Forces Communications and Electronics Association report "Evolutionary Acquisition Study" dated June 1993.

scheduled to coincide with the Defense Acquisition Board (DAB) reviews and transition from one phase to another (i.e., Demonstration and Validation to Engineering and Manufacturing Development [EMD]). The plan may require update after delivery of one or more evolutionary increments:

- Statement of Work
- Specifications
- Data Requirements
- Completion of the Acquisition Package preparation
- Purchase Request (indicating how the evolutionary option will be implemented)
- If other than full and open competition is required, justification and any required Determination and Findings approvals should be indicated here. (This is especially true if the evolutionary options is described).
- Issuance of a synopsis
- Issuance of a solicitation
- Beginning and completion of negotiations
- Contract preparation, review, and clearance.

1.4 Contract Awards: A Funding Profile and Contract Strategy should be provided. A summary should be included of the funding requirements for each increment of development; at least for the first increment. A contract strategy should be selected which tailors existing contract practice to the needs and structure of the evolving program.

1.5 System Engineering design reviews: For EA, reviews should be tailored for

each increment.

1.6 Contract deliveries (Delivery or Performance-period requirements): Describe the basis for establishing delivery or performance period requirements. Explain and provide reasons for any urgency if it results in concurrency of development and production or constitutes justification for not providing for full and open competition. (See page 4-2, Section 5).

1.7 Test and Evaluation periods: To the extent possible, describe the test program for both contractor and Government for each phase of the acquisition. (See page 4-1, Section 2).

1.8 Production Releases: A detailed release is required for each increment.

1.9 Operational Deployment Objectives: For each increment, indicate the date of approval for operational use. If waivers are requested, describe the need for them.

## 2.0 Discuss:

2.1 How the evolutionary option will be implemented including any degree of concurrency among the program technical tasks or if there will be portions of the program in separate phases of development. The need for long lead items.

2.2 Phase transition anticipated, (See Section 4).

3.0 List quantities of items to be procured for each increment including prototypes, engineering development models and production items. It is especially important to indicate when portions of the core

capability will be available.

4.0 Summarize the program on a single diagram indicating how the EA option permits providing deployable capabilities more rapidly and provides feedback for adjustment of later increments (see Figure 5.1).

### ***Section B: Acquisition Approach***

1.0 Overview: An architectural plan should be provided which describes the principles on which the system architecture is based. It should include a set of guiding principles for management, development and maintenance of the architecture and an outline of how the architecture is expected to be improved in the future. In addition, a Technology Road Map should be provided which projects availability of technological development, includes a survey of commercial off-the-shelf (COTS) products, and a projected schedule for emerging technologies.

1.1 Discuss basic acquisition strategy to include transition of critical technologies in technology demonstrations in the context of operational requirements and management approach for:

1.1.1 Prototypes of elements of an initial core capability and elements which will be added to the core as they become available.

1.1.2 Engineering Development Models (especially simulations) which validate the evolutionary development of core capability components and which show that system integration will be successful.

1.1.3 Plans for reducing the risk inherent in the development and how the choice of an evolutionary option will aid in risk reduction.

1.1.4 Non-Development Items (NDI). Identify the NDIs which could help shorten the time required to deploy core and subsequent add-on capabilities. Indicate the efforts (planned or under way) which will identify NDIs with emphasis on COTS items. Describe what arrangements have or will be made for logistics support of the NDI or COTS for its duration.

1.1.5 How the Evolutionary option will be implemented. Identify how it will provide for more rapid deployment of capabilities which satisfy operational requirements while facilitating use of the most advanced technology.

1.1.6 Information on planned product improvements which are included within the program and how the EA process will facilitate their achievement with less risk than would otherwise be possible.

1.2 Discuss applicable Government management responsibilities *vis-à-vis* the contractors, specifically with regard to:

1.2.1 System integration: Describe how the Government will perform that role if it is reserved to Government.

1.2.2 Government support of the system. Explain how the government and the contractor will support the system initially, and throughout the life cycle. Include consideration of government maintenance and servicing as the system evolves and the methodology for insuring distribution of commercial products as required during the sys-

tem operating life. An Integrated Logistic Plan (ILS) Plan should be provided. As with conventional approaches, ILS is critical in EA. The plan should insure that support resources and services are in place at the time the core (and all succeeding increments) is delivered .

1.2.3 Government Furnished Equipment (GFE). Indicate any equipment or property to be furnished to contractors including materials, facilities or commercial purchases. Discuss how schedule requirements will be met and how availability will be insured so that the system capabilities can evolve as planned

1.2.4 Government Furnished Information. Discuss any information to be provided to prospective offerers and to contractors after contract award. Indicate specific manuals, drawings, test data, or other Government generated or owned information involved in development and fielding each increment of system capability.

1.3 Discuss applicable contractor management responsibilities during the life of the contract and during succeeding support period. Discuss product assurance planning. Solid product assurance planning must include all aspects and phases of the system and be visible at decision milestones. Such planning should recognize specifically that in an EA program, the developer's responsibility must extend through deployment and operations, which might entail special maintenance or warranty provisions. Specific areas to be addressed are:

1.3.1 Systems integration tasks performed by the contractor, especially

items which are critical to the initial system capability. These must be tested individually and as expanding aggregations of components.

1.3.2 Contractor furnished equipment to be provided under the contract and for support of the initially fielded capability.

1.3.3 Contractor furnished data and information necessary to the government management activity and necessary to a using agency.

1.4 References for Acquisition Approach: Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) paragraphs which are to be related to paragraphs in this portion of the acquisition plan:

Part 7, subpart 7.1	FARS Paragraphs 7. 105(b)(6), (b)(12), (b)(13), (b)(14)
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Part 207, subpart 207.1	DFARS Paragraph 207. 105(b)(6), (b)(12)
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## 2.0 Streamlining

2.1 Discuss how EA permits process streamlining through combining work which otherwise would have been performed later in program development. This can result in combining program phases or eliminating some of them entirely. Also discuss how EA permits use of consolidated, simplified program documentation and streamlined contractual requirements.

2.2 Identify the need for any waivers or deviations.

2.3 Discuss any application of Defense Enterprise Programs or milestone authorizations.

2.4 Indicate how the process better accommodates legislative direction; specifically, how use of COTS and NDI can assist in "competitive prototyping." If live fire testing is required for the program, indicate how an EA process can help achieve it.

2.5 FAR and DFARS regulations to be related to these paragraphs in the acquisition plan are:

Part 7, subpart 7.1	FARS Paragraph 7.105(a)(8)
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Part 207, subpart 207.1	DFARS Paragraph 207.105(a)(8)
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### 3.0 Sources

3.1 Indicate sources of supplies and services. Consider needs for the entire program. If the acquisition (or any part of it) is for commercial-type products (or if commercial-type products are a major portion of the materials included in the system) address the methodology to be used in determining availability and sources of continuing supply. If no make survey is to be conducted, explain why. Also discuss energy conservation measures, standardization concepts and industrial readiness.

3.2 Include consideration of small business or small disadvantaged business; labor surplus areas or the need to create or preserve domestic sources of program systems components. Discuss

how the acquisition strategy contributes to Industrial Preparedness Objectives and to Surge and Mobilization objectives or contingency support and reconstitution; include any specific plan either by text or reference. If no plan is available, summarize the analysis of impact details of these objectives on selection of EA.

3.3. For Acquisition Category I programs, include analysis and assessment of how the Defense Industrial Base issues (See Title 10 United States Code [USC] Section 2502: Policies relating to defense industrial base) impact on system development, the capability to produce and maintain developed systems and the quality of those systems. Also discuss system support and how reliability and maintainability are enhanced by selecting EA. Indicate how EA can help assure extensive use of warranties for COTS and NDI. Discuss how competitive development can be facilitated by competing the COTS and NDI elements of the evolving system. Include any impact on standardization considerations (Type Classification): specifically, how to make future equipment purchases from the same sources. Indicate how competition can help insure at least two production sources for COTS and NDI production items.

3.4. The FARs related to these paragraphs in the acquisition plan are:

Part 7, subpart 7.1	FARS Paragraph 7.105(b)(1), 7.105 (b)(17), 7.106(b)
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Part 207, subpart 207.1	DFARS Paragraph 207.105(b)(17)
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#### 4.0 Competition

207. 106(b)(1)(A),  
207. 106(b)(1)(B)

4.1 Explain how EA will maximize competition throughout each phase of the entire life cycle. Discuss competitive and noncompetitive aspects of each phase and describe how competition will be sought, promoted and sustained for the system, all subsystems, major components and spare parts. Specifically, discuss results of breakout reviews and breakout strategy relative to each system element and identify key components and logistics milestones (e.g., technical data delivery schedule conferences) which affect competition. If continuing contracts for services are required, discuss how they will be achieved.

4.2 Discuss the use of repurchased data to increase competition. Include estimated costs and funding availability to repurchase data. Discuss contractual approaches for acquiring such data and how it will be used. Detail technical data rights and patent considerations.

4.3 Discuss the results of detailed components breakout reviews for major components and subsystems and whether such items should be Government Furnished Equipment (GFE). Present an analysis of reviews in accordance with DFARS Appendix D - Component Breakout.

4.4 The FARs to be related to these paragraphs in the acquisition plan are:

Part 7,  
subpart 7.1

FARS  
Paragraph  
7.105(b)(2),  
(b)(12)

Part 207,

DFARS

subpart 207.1

Paragraph  
207.105(b)(2)

#### 5.0 Contract Types

5.1 For each phase, discuss the types of contracts anticipated. Include in the discussion considerations of multi-year contracting, any special clauses or solicitation provisions, and whether sealed bidding (possibly for COTS and NDI items) or negotiation methodology is applicable for the system and its components.

5.2 Include discussion of risk and provide risk assessment information which supports choice of the type of contract. Include a discussion of risk-sharing by Government and contractors.

5.3 Identify the incentive structure. Specifically, in connection with industrial preparedness planning, industrial base, COTS and NDI considerations, provide a rationale for incentives to invest in capital facilities, capital equipment, and advanced technology.

5.4 Address all existing or contemplated deviations or waivers particularly any which result from selection of an EA option.

5.5. Discuss fixed price development contracts requiring Defense Acquisition Executive approval: specifically, contracts in excess of \$25 million (or lower amount if prescribed by law), or fixed price contracts for lead ships. Indicate whether waivers are required for any phase of the fixed price contract.

5.6. The FARs related to those paragraphs in the acquisition plan are:

Part 7,

FARS

subpart 7.1

Paragraph  
7.105(b)(4)

Part 207,  
subpart 207.1

DFARS  
Paragraph  
207.105(b)(17)(A)

during which an initial capability is developed and deployed; and periods within which incremental capabilities are developed and deployed. Note that there is uncertainty about the exact dates of initial and subsequent capability delivery. These kinds of uncertainties are also reflected in costs projected for any capability

## 6.0 Major Trade-offs

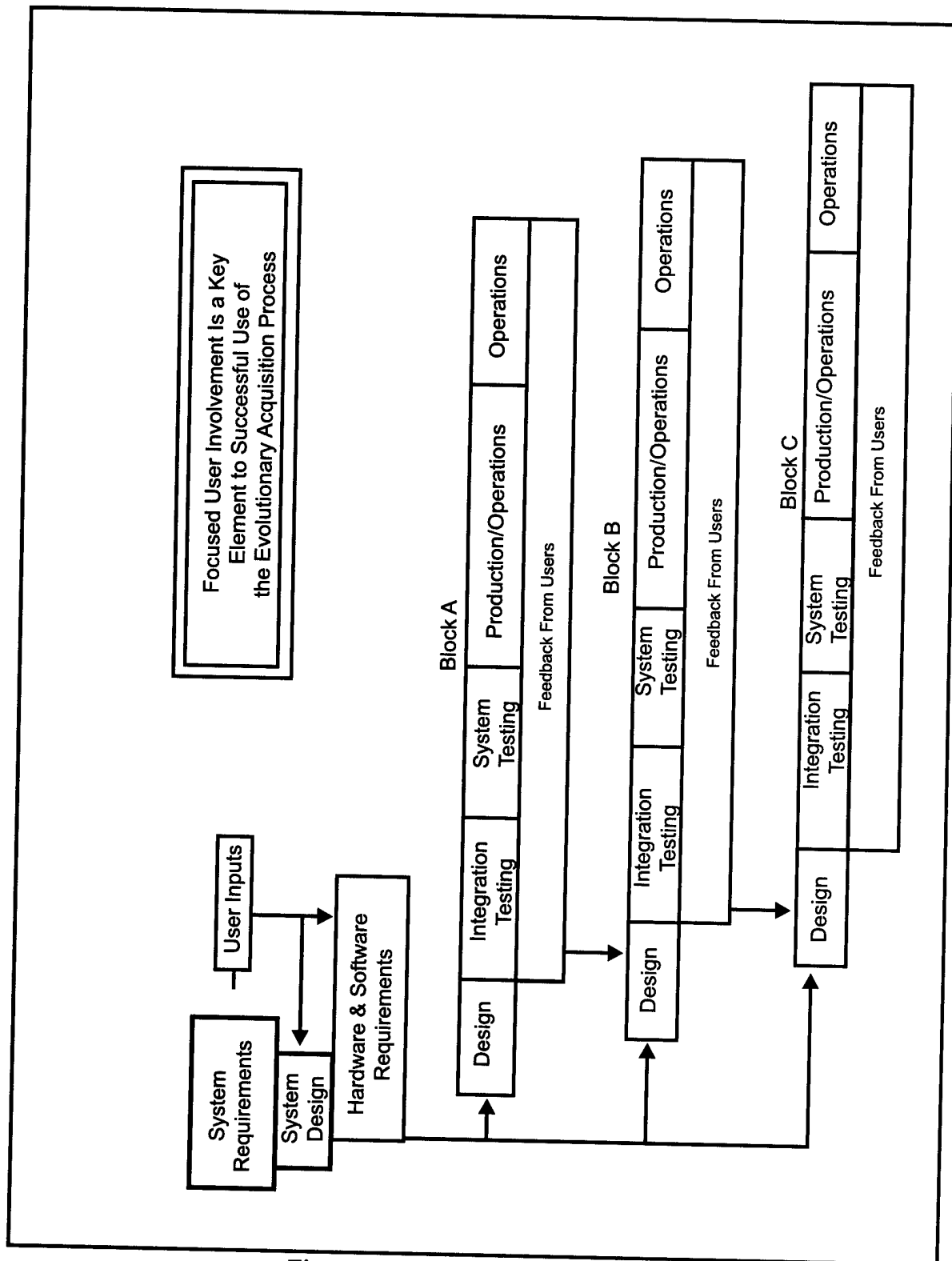
Identify major trade-off decisions, especially any trade-offs between cost, schedule and performance. Identify major trade-off decisions to be retained by milestone decision authority. Any trade-off to be included in formal solicitations must be identified and discussed in depth.

### Evolutionary Acquisition Summary

Figure 5.1 shows how the EA process proceeds with weapon development. The development time is divided into a period

### Sources of Additional Information

The Defense Systems Management College (DSMC) plans to continue its support of the Joint Logistics Commanders Evolutionary Acquisition initiatives. In that regard, if there are questions about these guidelines or their implementation, discussion with DSMC's Systems Engineering Department is encouraged.



Focused User Involvement Is a Key Element to Successful Use of the Evolutionary Acquisition Process

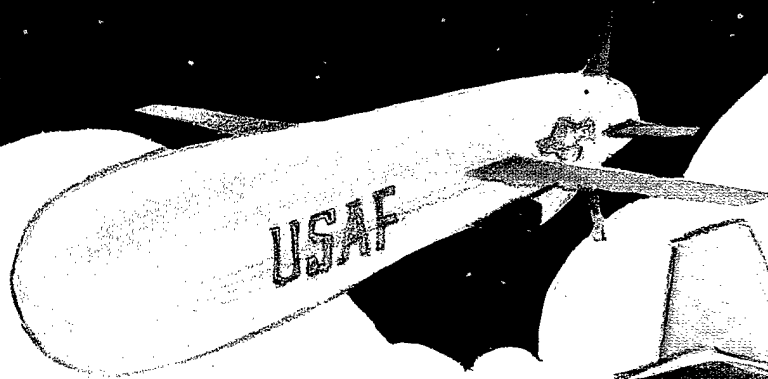
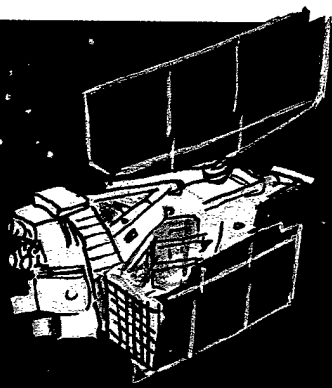
Figure 5-1. Evolutionary Acquisition

# APPENDIX A

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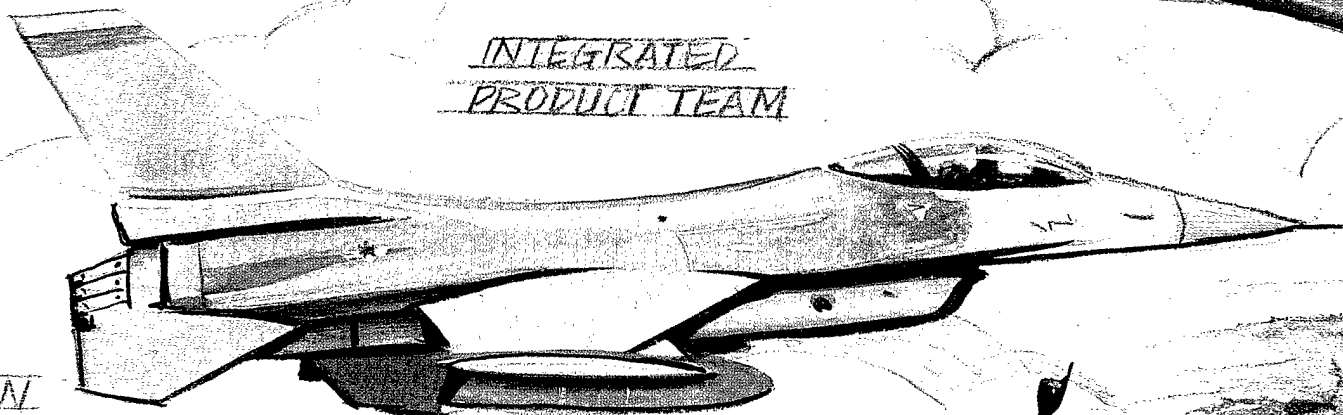
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FLEXIBILITY IN DESIGN

COMMAND SUPPORT

INTEGRATED  
PRODUCT TEAM



PLAN  
FOR UNCERTAINTY

ACCOMMODATE CHANGE

TAILOR THE STRATEGY

EARLY ILS PLANNING

